

Art. V. 1.
R E M A R K S

O N T H E

D I F F E R E N T C O N S T R U C T I O N S

O F

B R I D G E S,

A N D

I M P R O V E M E N T S

To secure their

F O U N D A T I O N S

On the different S O I L S where they are
intended to be Built.

Which hitherto seems to have been a Thing not
sufficiently consider'd.

L O N D O N :

Printed for the AUTHOR; and Sold by J. JOLLIFFE, in St *James's*
Street; E. COMYNS, at the *Royal Exchange*; A. DODD, near *Temple-*
Bar; and B. TOVEY, in *Westminster Hall*. M.DCC.XLIX.

REMARKS

ON THE

DIFFERENT CONSTRUCTIONS

OF

BRIDGES

AND

IMPROVEMENTS

To secure their

FOUNDATIONS

On the different Soils where they are
intended to be Built.

Which hitherto seems to have been a Thing not
sufficiently consider'd.

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REMARKS

On the different CONSTRUCTIONS of

BRIDGES.



FIRST the Foundation intended must be carefully bored, and the Soil brought up, and taken out of the Shell of the Tool every Foot or eighteen Inches, and laid on a Board, with the Remarks following; as an expert Sugar-Cooper does by a Cask of Sugar, when

when imported, to know and judge of the different Sorts contained in it.

This is the Soil of 18 Inches.

This of - - - 2 Feet.

This of - - - 3 Feet, &c.

And this must be done, till you are satisfied with the Goodness and Firmness of the Foundation: And if it does not prove equally firm, under each Pier intended, it must by Art be made sufficient; Piling it all over, and then inclosing it with dove-tail'd Piles and Pallaplace quite round the Soil where you purpose to erect each Pier: And this may be thicker or thinner set with Piles, as the Nature of the Spot may require.

THE *French*, in most of their Works and Foundations of Bridges, have done it with Cofferdams, in order to drive the Piles within them. This, in a great Depth of Water, is both hazardous and expensive, therefore not to be recommended in all Cases. For there are Foundations which are very full of Water-Springs, and have a loose kind of Gravel,

vel, called a *Shingle*. When Springs happen in such a Soil, they boil up and raise the Sand to a great Height. In such a Case, it is very difficult to bore the Ground so as to bring up the Contents, by any Tool. For this Purpose there must be a Pile prepared and shod, having a Groove in the Side, either Square or Round. The Round Groove for this Purpose, may be made with the Auger that usually bores the first Hole in Pumps; and, when bored, is to be left entirely open on the Outside. This Pile is then to be driven into the Soil of the intended Foundations, as deep as you well can, and the Tool you bore with must be applied to, and work'd in the Groove of such Pile: By which means, you will be better able to draw up the Soil of each Layer or Stratum of Earth in the Shell of your Tool; being especially careful when you draw it to keep the hollow Part toward the Body of the Pile. This is done by marking the Shank of the Tool with Divisions in a proper manner.

THUS will you obtain the Depth of each Stratum or Layer of Earth by Degrees: And this is a most

most material Point. For if you imagine the Stratum of Gravel or any other Soil to be deeper than it really is, you run into an Error not easily remedied, (and this, I am afraid, is the Case of the failing Pier of *Westminster* Bridge.) For if you sink your Foundation too deep in the Bed of Gravel, or any other Stratum, the Weight of the Pier may break through to another Stratum, of a Nature more soft, near which there may possibly be a Spring, which rising, will force away the lighter Particles of the Soil, and cause in Time a Hole or Cavity under the Bottom of the Pier *.

WHAT I have here said, is by no means intended as a Reflection on any Persons concerned in the Building of *Westminster* Bridge: The Misfortune under which they at present labour, might have befallen any one. As for Instance, the Bridge over the River *Allier*, in the City of *Moulins*, in the *Bourbonois*, which fell down as soon as the Centers were

* It is found by Experience, in sinking Cavities in the Earth, that the Issuings of Springs is not from the solid Strata, but from the Joints or Interstices; they, being of looser Texture, divide one Stratum of Earth from another.

were struck. Yet every Body knows that *France* abounds with great Engineers. A Drawing of the Ruins of which Bridge I brought from *Paris*, and have now by me.

It has been always esteemed a Work of the utmost Care and Attention, to lay the Foundations of Piers, in a great Depth of Water, as I was informed by the most experienced Engineers in *France*, with whom I conversed when at *Paris*, being sent with Admiral *Knowles*, for that Purpose. The Names of those Gentlemen were *Gautier*, *Gabriel*, and *Lambote*, all Persons of great Judgement and Abilities. The latter was principally concerned in that noble Edifice the Bridge of *Blois*. I found by their Friendly Instructions, that they did not endeavour to keep Works of this kind a Secret; but apprized me of all the Difficulties that might attend them.

SINCE that Time, I have seen and reduced to Practice part of the useful Advices they communicated, as I hope the Bridges at *Brentford* and *Chertsey*, &c. are some sort of Evidence.

As I now offer my Opinion, not to any particular Party, but to the World in general, I shall esteem it a Reward sufficient, if any Hints I give are acceptable to Men of Candour and Judgement, and useful to my Country. One Advantage, I flatter myself, will accrue from this Treatise, small as it is, as it may give an Idea for Repairing the Sinking Pier of *Westminster* Bridge; and, for the Future, set aside the Use of Coffer-dams and Cassons.

By the Method I propose, the Piers of any Bridge may be prepared a Mile or two from the Place of erecting such an Edifice, especially where the Tide ebbs and flows: For the Piers may be floated thither whole, as is more fully explained in *Plate II.* and so set down on a sound Foundation, well secured, as recommended *Plate I. Fig. 2.* In which Case, the Piles may be cut off under Water, smooth and level, by a particular Machine, the Model of which may be viewed at the Place of Sale of this Pamphlet, or the Author's House. He hath likewise an Instrument, invented for driving Piles under an Arch, where

where there is no Room for a Gin to come to work.

PLATE IV. explains the Use of the Piles, and the Manner of inclosing the Ground under a yielding Pier, under the Water, if such a Case should happen. By it you may see, that the Foundation of any Pier, in those Circumstances, may be secured, if taken in Time.

IN PLATE IV. is also exhibited a Truss or Scaffold, that may be applied, as a Passage from Pier to Pier, over the sinking One, to prevent and resist the Pressure of the Arches on each Side of the failing Pier. There is represented likewise a Barge or Gin under the Scaffold, to shew there will be Room sufficient to drive Piles under the Truss; and it will give Leave for the Centers to be taken down or put up, and leave the Truss still standing.

ALTHOUGH there should be no Danger from the Pressure of the other standing Arches, yet would I not choose to trust it without such a Help; it be-

ing of no great Charge, as, there will not be more than eight or ten Truffles wanting. And I hope no Gentleman will be displeased at this Remark, since Experience tells us, the simplest and most easy Remedies are often, if not always, the best.

It is every Man's Duty to be of as much Service as possibly he can; and if he does his Endeavour, his Services, though not great, may yet be sincere: and I hope mine will be accepted accordingly. And should my Notions be wrong, they may be perhaps of Use to excite Men of greater Judgement and Abilities, to deliver their Sentiments on the same Subject. If, on the contrary, they appear agreeable to Reason, I shall enjoy the Satisfaction of not being thought a useless Member of Society.



EXPLANATION of the PLATES.

PLATE I. *Fig. 1.* is a Pile grooved for the Boring Tool to be put down, and brought up in the Groove, to shew the different Soils it has gone through. *Fig. 2.* Is the Manner of Piling the Foundation of a Pier, and inclosing the Ground it stands on with dove-tail'd Piles.

PLATE II. is a Stone Pier, as A.

B is the Side or Profile of a Frame of Timber.

CC are the Ends of two Pieces of Timber, to be put close to the Sides of the Stone Pier, and are bolted through the Pieces of Timber, or Frame that lies cross the Pier, as in *Plate III.* And a Piece of 4 Inches is spiked to the Side of them, to make a Cavity between the under Part of the Framing and the Head of the Pier, for the Irons that go through the Barge to turn in.

DD the prick'd Lines in *Plate III.* represent the Head of the Pier, on which the Frame is put.

EE, &c. are 26 Irons that are fixed on each Side the Pier; 13 of them being screw'd into the the bottom Timbers on which the Pier stands, and 13 are hook'd to the Sides, and all fasten'd on the upper Side of the Framing that is on the Pier.

FFF, &c. *Plate II.* are Pieces laid on the Frame, for the Barges to be fixed on, to make a Cavity for the Head of the Irons to be fastened to, between.

GGG are the End or Section of 3 Barges, having two Pieces of Timber fixed to the Bottom of each, with 26 Irons made like a T with an Eye at Top, to be turned with a Handspike, to fasten the Barge to the Framing at once, when all the other Works are fixed.

THE Iron on the other Side of the Pier, as H, is different: For to those Piers that are prepared under the Shore, near the Mafon's Wharf, there are Eyes fixed to the Bottom of the Pier, as I I, into which the Irons are to be hook'd, in order to carry it away, and place it on its Foundation.

K K K K represent the Sides and Ends of empty Brewers Butts, to be applied as they shall be wanted, in Case the Barges will not be sufficient to float the Pier, and bear it away.

THE Sinking Pier of *Westminster* Bridge weighs Nine Hundred Tons, within two Feet of Low Water. But as *Portland* Stone weighs less than two Thirds of its absolute Weight in Water, which reduces the Weight to less than Six Hundred Tons: If then each Barge can carry 250 Tons, 3 Barges will lift more than is required to float the Pier, besides what the Timber of the framing will be allow'd to poize.

THE

THE Boring the Holes in the Timbers on each Side of the Bottom of the Pier, will be done under Water, by means of an Iron Tube, somewhat like a Gun-Barrel, with a Point on each Side, to stick into the Timber where the Hole is intended to be bored, chiefly to direct the Auger to the Hole again, when 'tis drawn up to be emptied. And when the Hole is finished, the Iron, with a stout Wood-screw at the End, is to be screwed well into its Place, as at E in *Plate II*.

PLATE IV. represents a Truss or Scaffold, fixed between the next two Piers, to receive the Thrust of the Arches, if they should be inclined to spread.

L L L. is the Front of an Engine and Barge to drive Piles, and is here placed under the Truss, to shew there is Height enough to work it in that Situation.

M is

M is a Pile that has a Notch of about 4 Inches, made to receive a Timber, wanting to be supported, in Case of a Failure, under Water.

N is a Wedge Pile dove-tail'd into M, to be driven at the Back of it, when M is at its due or proper Depth; that is, when the Notch of M is over against the Timber it is intended to Support, which the Wedge Pile will then force up to its Bearing.

It is hoped that the Reader will excuse any Inaccuracies that in this small Performance may have escaped the Notice of

His most Humble Servant,

Horse-Ferry, Westminster,
May 5. 1749.

Charles Marquand.

1871

It is a pleasure to have you here.

I am very glad to hear of your success.

I hope you will continue to improve.

I am sure you will do so.

I am very glad to hear of your success.

I hope you will continue to improve.

I am sure you will do so.

I am very glad to hear of your success.

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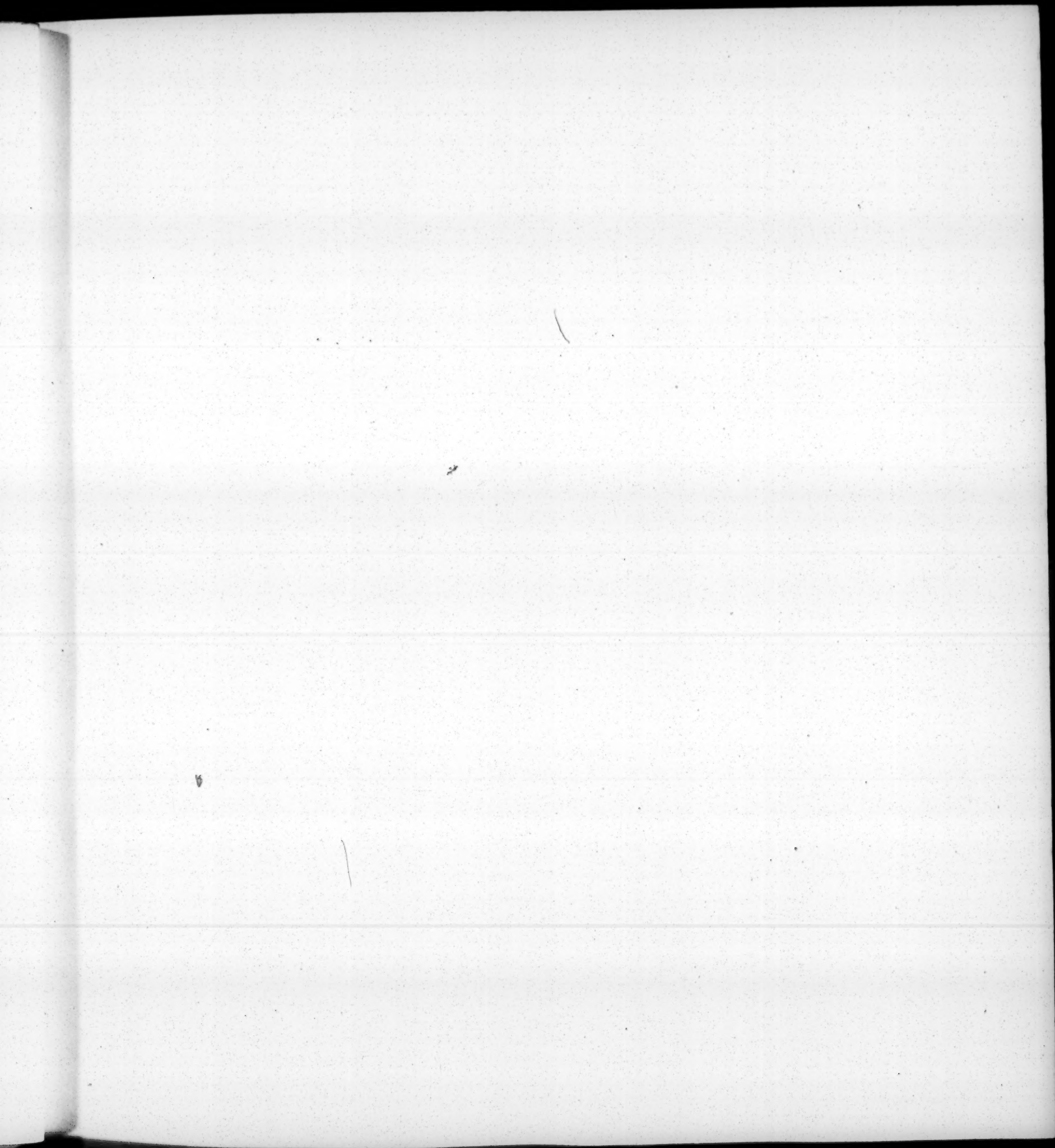




Fig. 1.

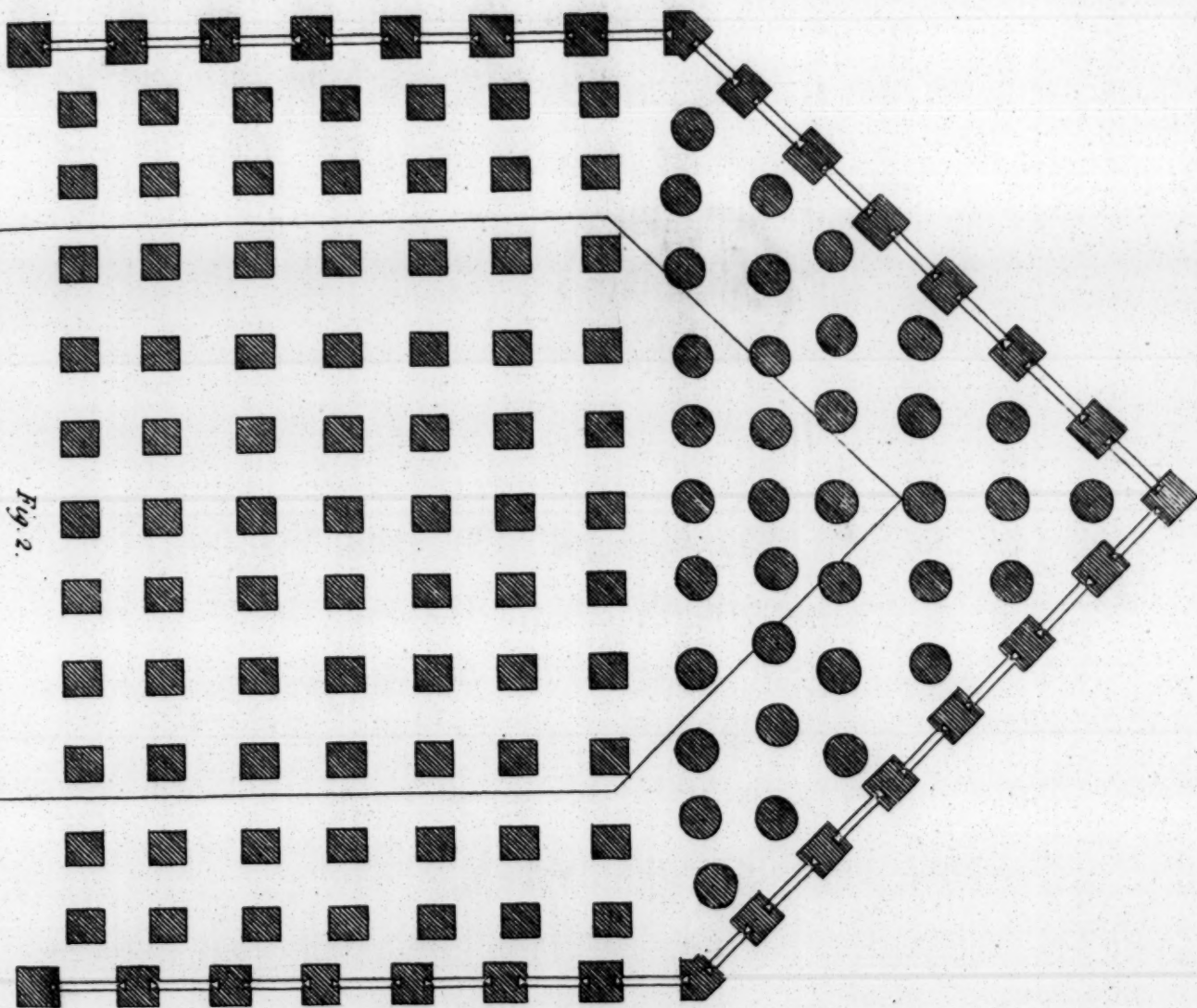
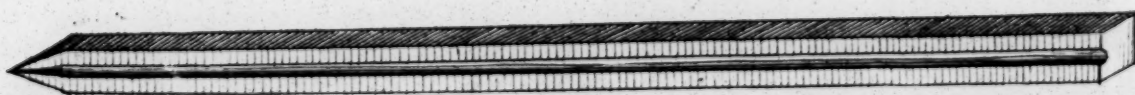
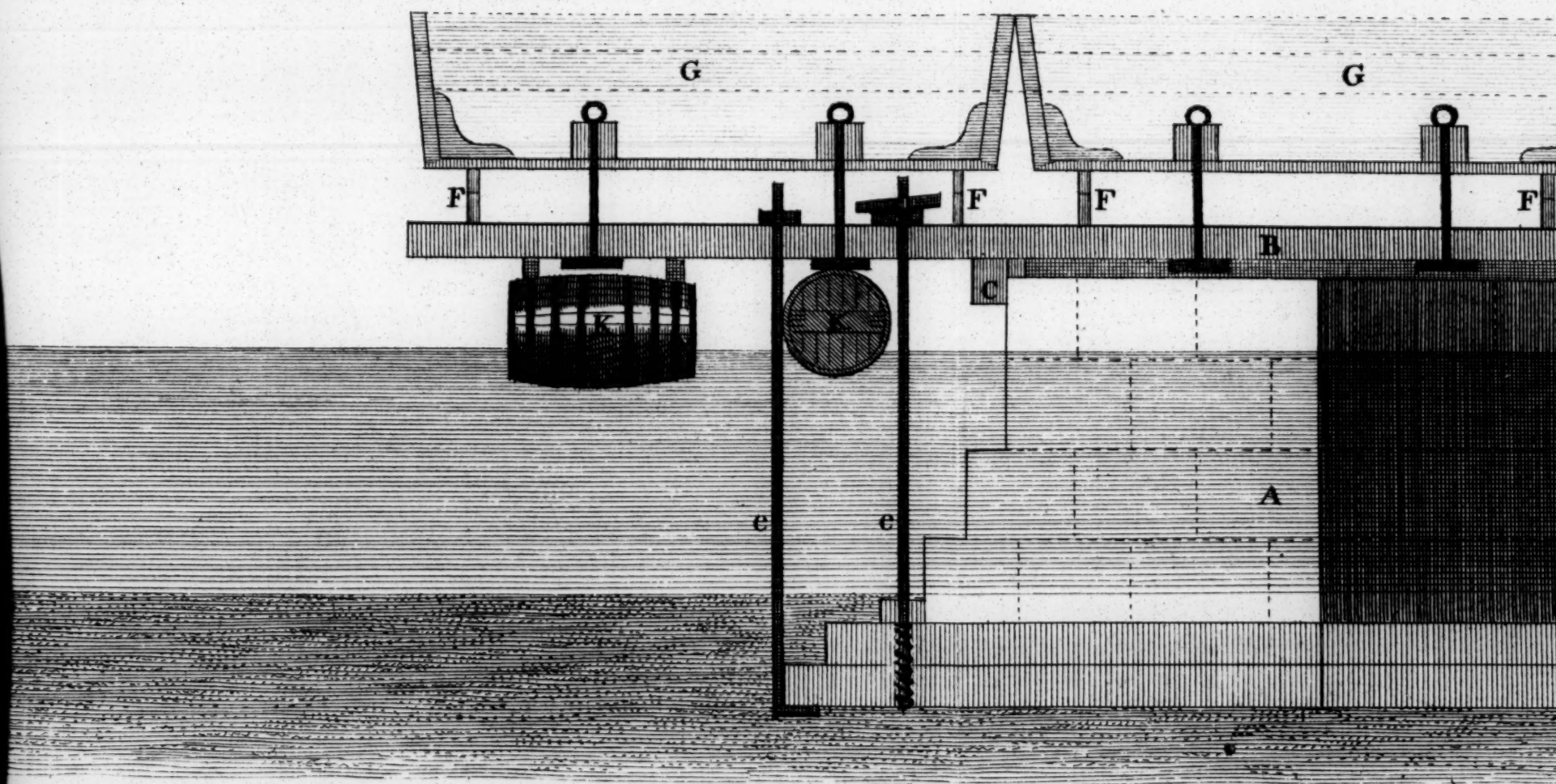
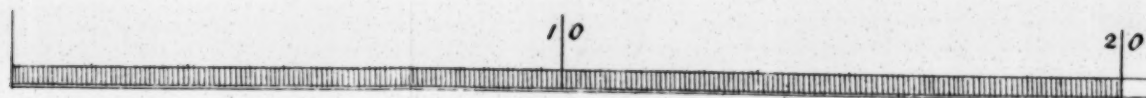
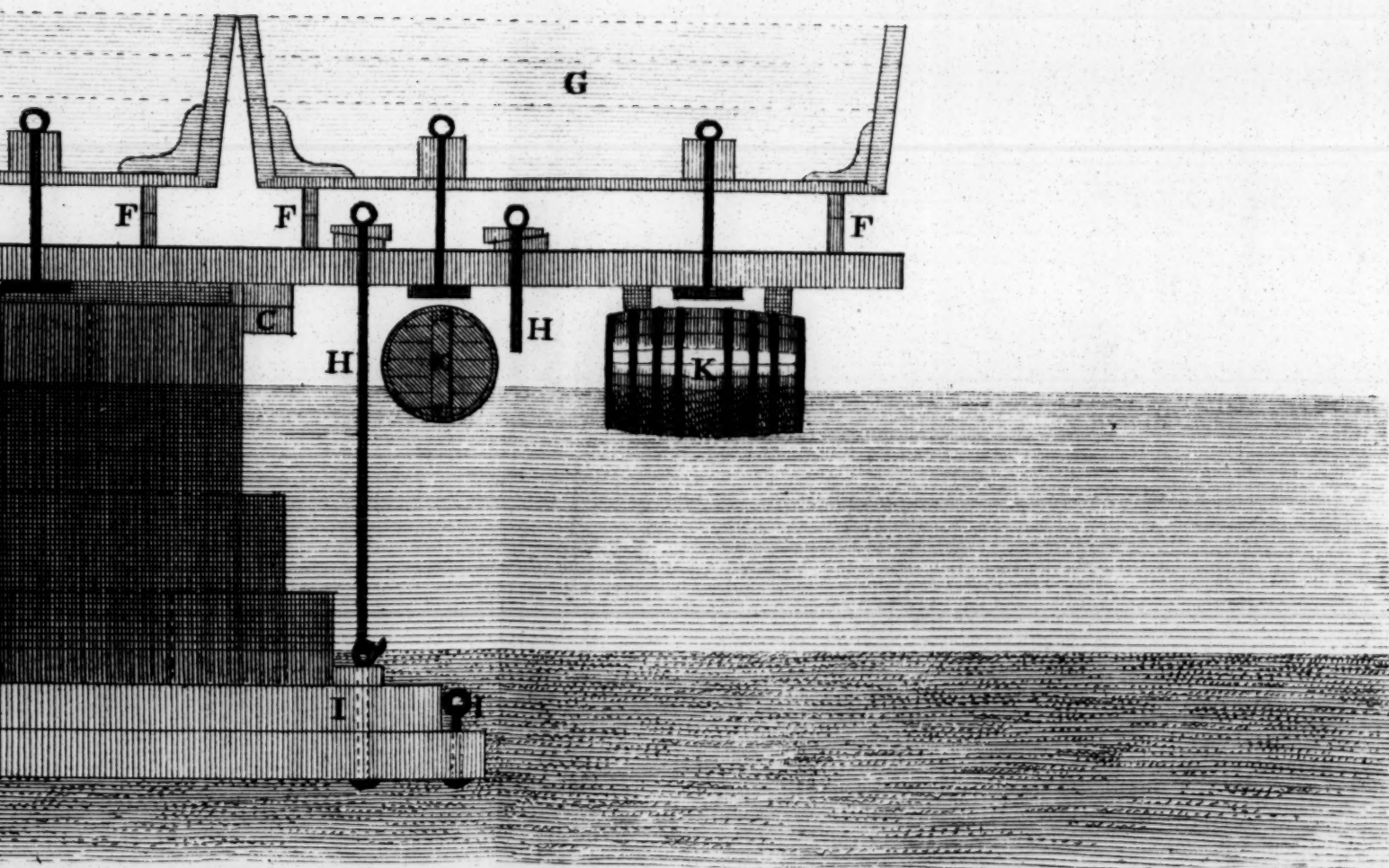


Fig. 2.





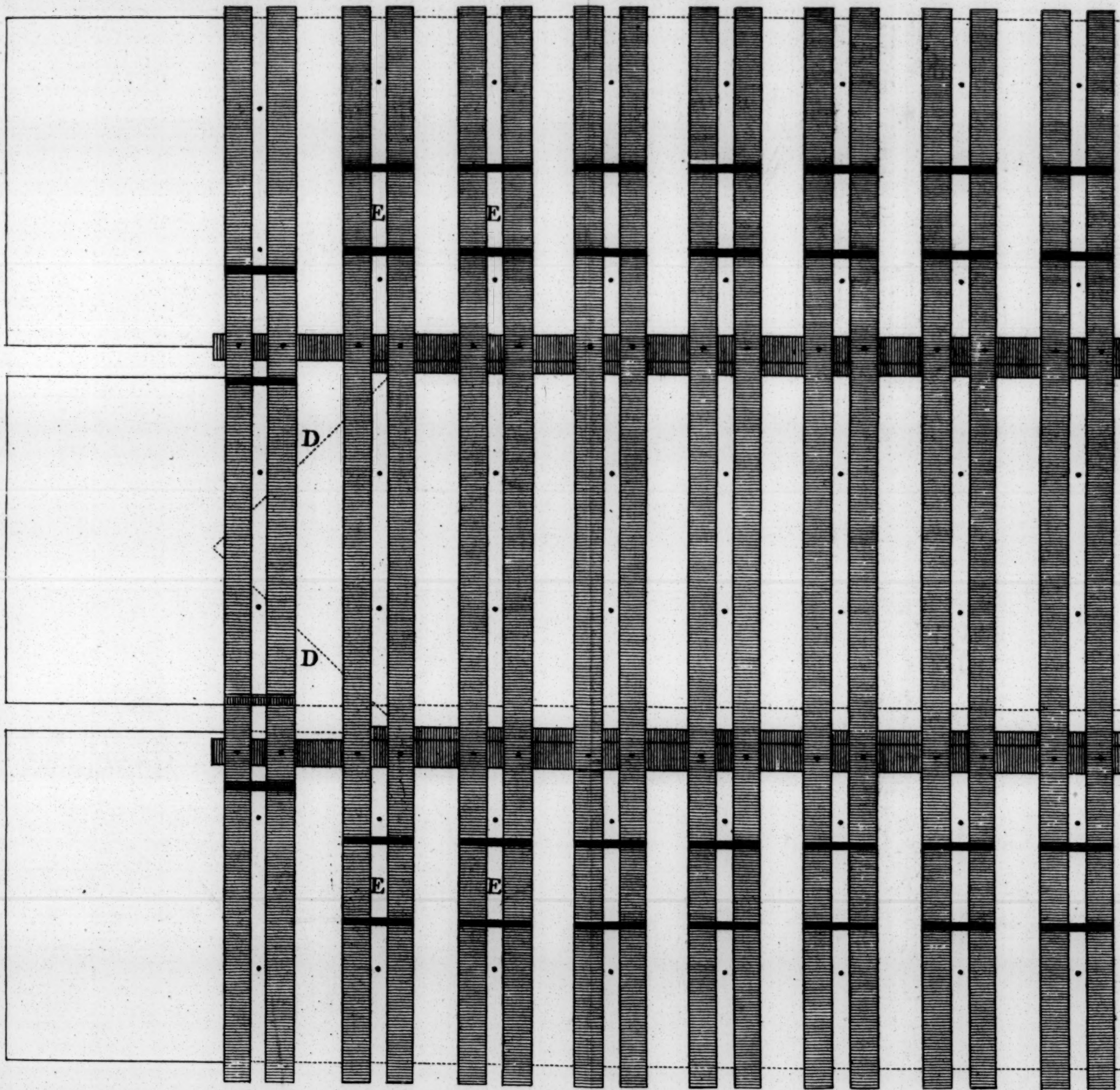
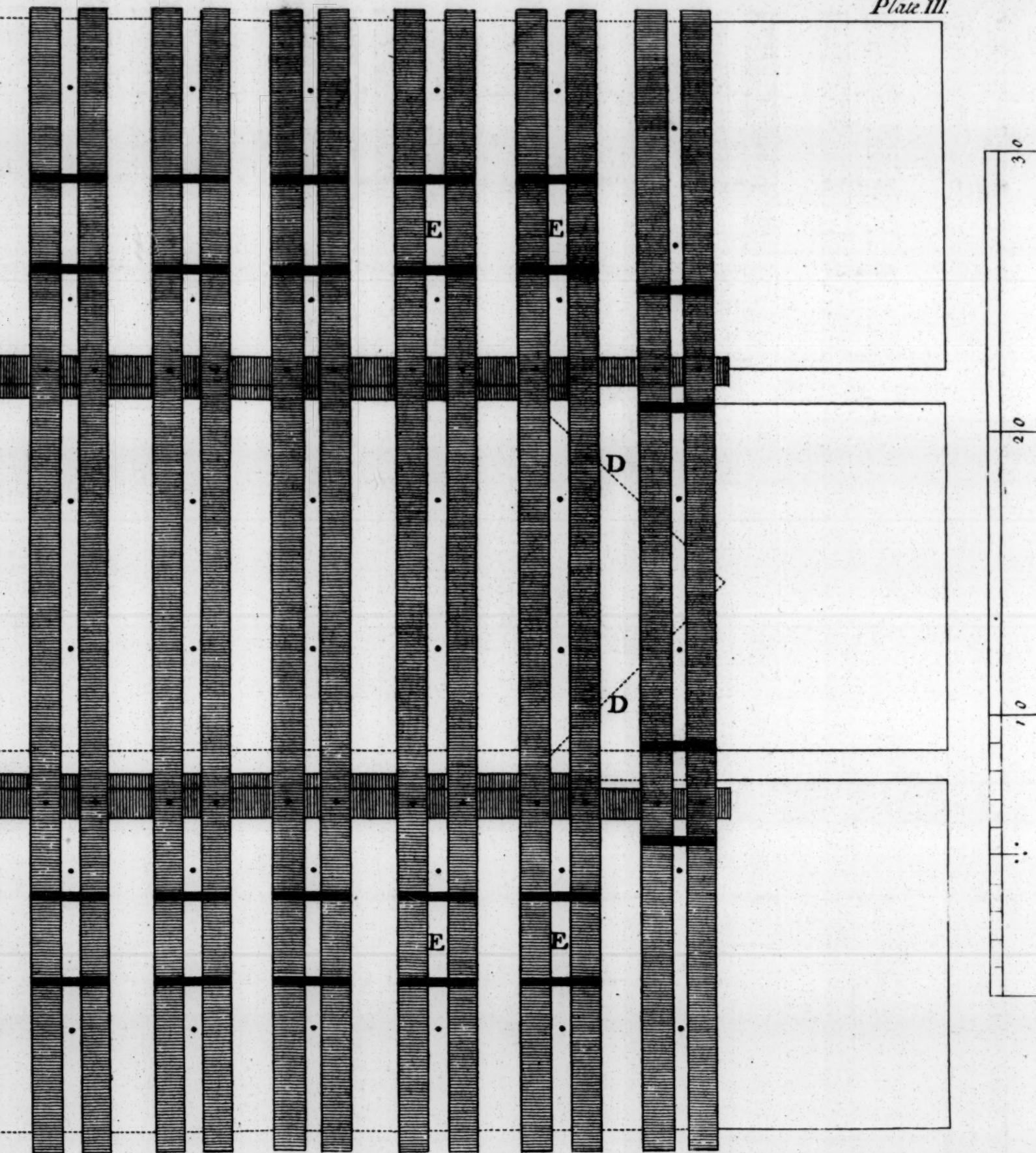
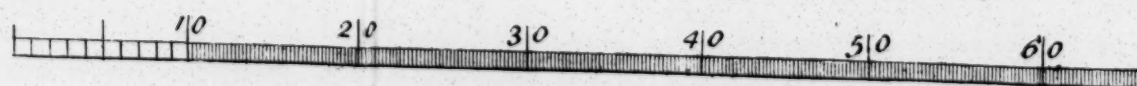
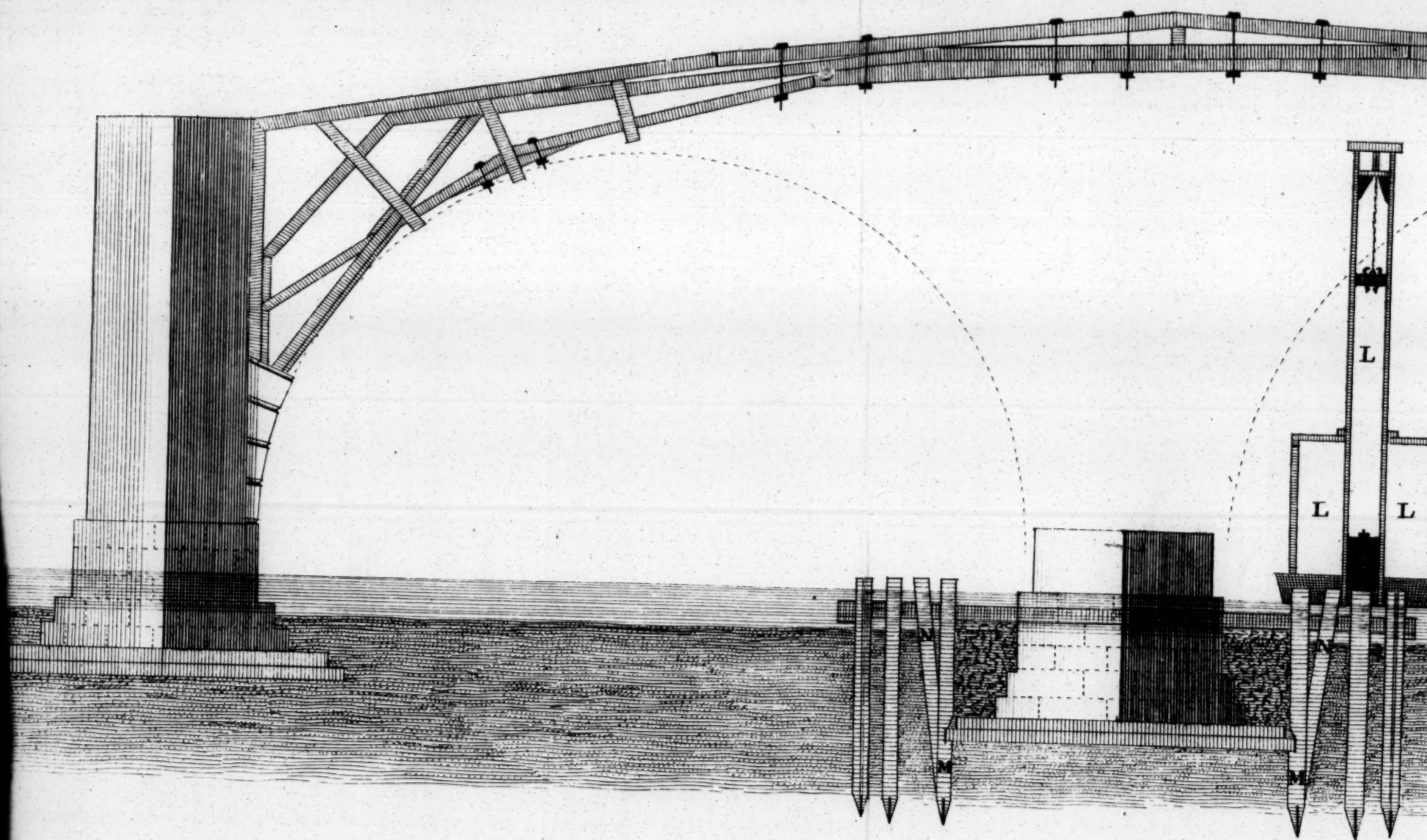


Plate III.





Plat. IV.

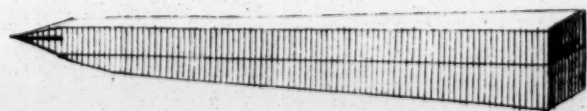
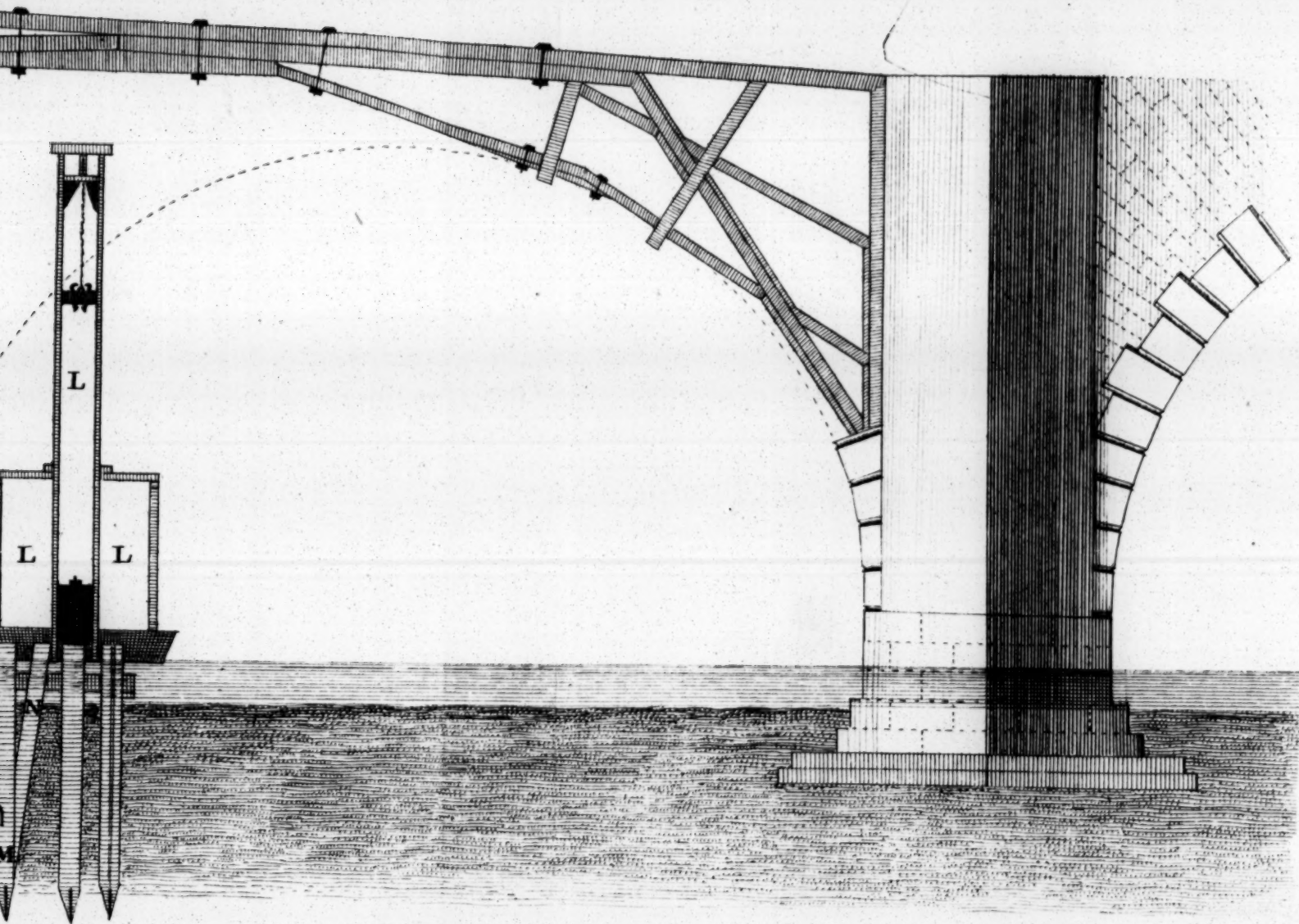


Fig. 1.

